

Region 1 FY 2013 Invasive Species Control Program Proposal Format

Refuge name: Palmyra Atoll National Wildlife refuge

Project title: Corallimorph control and eradication at Palmyra Atoll NWR

Total amount requested: \$40,000

Project description:

The coral reefs at Palmyra Atoll National Wildlife Refuge (Palmyra) are under attack from an invasive corallimorph, *Rhodactis howesii*, an anemone like species that is out competing corals and smothering the reef. *R. howesii* were seen increasing in number on the western terrace of Palmyra after a long-line fishing vessel wrecked in the area in 1991. Available data including two surveys of the infestation in 2007 and 2011 suggests the vessel is fueling the growth of *R. howesii* perhaps by releasing iron, a limited element in seawater. The corallimorph is currently spreading over once pristine coral reefs, killing and smothering corals and turning an area once rich in species diversity into a monotypic blanket of corallimorph. Recent surveys in 2011 show that *R. howesii* has now spread over 250 acres of reef smothering corals across the western terrace and on the north and south fore reefs of the atoll. The speed at which the corallimorph is spreading poses a serious threat to the health of the reefs surrounding Palmyra and the coral reef ecosystem as a whole. In the past few years several control and eradication methods have been trialed, three of which have been proven successful. One of these (Tarp method) involves killing all organisms on the benthos using bleach and tarps and would be suitable for eradication in areas where corallimorph cover exceeds 60%. Pilot studies using this method show that once cleared from the substrate, corallimorph do not recover for at least a year. A second method (focal treatment) involves killing individual corallimorphs using calcium bicarbonate and is more suited to eradication in areas where corallimorph cover is equal to that of corals (thereby limiting collateral damage). Pilot studies also reveal that reef fish will eat corallimorphs. We hypothesize, therefore, that if large enough areas are treated, local predators will limit corallimorph densities and allow recovery of the reef. The goal of the corallimorph control project is to scale up these control effort by treating 20 acres at the periphery of the expansion with focal treatment, and 10 acres in select portions of the high density areas using tarp method.

Comment [BFW1]: A major concern is that this proposal can only address 30 acres (albeit prioritizing the frontline, which is wise) of a 250-acre infestation.

Distinct project with well-defined objectives:

In the late fall of 2013, the Service will remove the ship wreck. This is a high priority project and funding has been allocated by Washington and the Chief of the Refuge System to remove the wreck, but not to monitor and restore the affected coral reef. The removal of the wreck gives the service the opportunity to perform a wonderful before and after eradication project that will coincide with the larger wreck removal. The removal of the wreck will eliminate the “fertilizer factor” that gives *R. howesii* an advantage over other benthic organisms, acceleration the growth and reproduction of this invasive species. With the wreck removed, eradication and control methods will be significantly more effective. Investigation into control methods have successfully proven three methods that can combat *R. howesii* at all population densities, from areas of 100 % corallimorph cover, to areas on the outer edge of the infestation where corallimorph are just starting to encroach upon highly sensitive intact coral areas. These three eradication methods have had 100% removal success with corals and other important successional benthic species recruiting into cleared plots, within weeks of removal.

Due to its protected status as a NWR Palmyra has few anthropogenic stressors and can be used as a model for resilience and restoration of coral reefs. The removal of the wreck and subsequent restoration efforts, gives the service an opportunity to collect a robust data set of biotic and abiotic factors for a Before-After-Control-Impact study design to determine the effects of corallimorph removal, and the subsequent succession of native species after invasive species removal. This project will give the Service the opportunity to study a phase shift rarely seen in coral reef ecosystems, from a community dominated by an invasive species back to a coral dominated system. The objectives for the project are:

Comment [BFW2]: If we're lucky!

1. To scale up control methods to evaluate their efficacy in removing CM and allowing for reef recovery.
2. Reduce corallimorph numbers in high density areas and thus limit the sink of available recruits thereby maximizing the opportunity for recovery of reefs.

Potential for maximum control:

With the wreck removed the eradication project will have the ability to successfully combat the invasion. Due to the reproductive strategies of this invasive, creating “fire breaks” will be key to stopping the expansion. With the elimination of “hot spots”, pockets of high corallimorph density, these areas will no longer act as source populations for the overall expansion, and the spread at the outer edge will be slowed. Once the expansion is slowed and high density areas are removed, the sink populations will no longer have a bank for recruitment of high numbers of individuals and the population as a whole can be controlled, completely eradicated from areas, and brought back to natural population levels. Since the corallimorph is found across areas in high and low densities the treatment methods can be tailored to the coral community that is being attacked.

This will be an ongoing project and additional ISCP funds will be needed in subsequent years to complete the project and maintain the results. It is anticipated that with enough funding and personnel, *R. howesii*, can be brought back to pre-2004 population densities by 2015.

Comment [BFW3]: That is encouraging. How many acres would that be?

Biological benefit to priority species:

Of the 66 species of reef building corals proposed by NOAA to be listed under the Endangered Species Act, 15 occur on Palmyra, and are presently being smothered or encroached upon by corallimorph. The control and eradication of the corallimorph will directly affect these endangered corals. Bumphead parrotfish and Humphead wrasse are also priority species and are listed as vulnerable and threatened on the IUCN red list. These fish are among over 418 fish species that are dependent on the coral reefs of Palmyra for food and shelter, habitat which is being destroyed as a result of the shipwreck and corallimorph.

The Refuge is currently working on the draft CCP for Palmyra Atoll NWR wherein Objective 4.2 is to restore coral reefs impacted by the shipwreck and invasive species corallimorph by removing the shipwreck and prevent the further spread of corallimorph by removal or control of its leading edge into native coral habitats. Along with the removal of the ship wreck, the service will restore 150 acres of the western terrace and fringing reefs by reducing corallimorph invasion by 70 percent of the 2011 mapped distribution within 5 years.

Utilizes the principles of Integrated Pest Management:

The time for early detection and rapid response has passed and unfortunately this invasive species is well established and wreaking havoc on the reefs. However, there is no time to waste and we cannot give up. This is a prime opportunity for a before during and after study. The methods have been vetted and it is time to act. Tarping will occur in areas of 100% corallimorph cover to create wide fire break in high density areas. These areas will reduce the expansion of the source population. The source population can then be systematically controlled and shrunk in size. The spot treatment method will be used in the periphery zone to halt the spread of the invasive into pristine and delicate coral areas.

Monitoring to document and evaluate project success:

Rates of Recovery and Succession after removal of corallimorph will be monitored by establishing permanent plots in the area with in the densest concentration of corallimorph invasion, near the wreck site, as well as a number of other sites on the periphery of the invasion. Five to ten permanent photo-quadrats will be created at each of these sites and pre and post treatment photographs of each plot will be taken. Plots will be monitored and surveyed for removal efficacy, corallimorph re-growth, and corallimorph recruitment, as well as, coral, algal and benthic invertebrate recruitment, growth and survival.

Comment [BFW4]: Any way to map the invasion now and in the future? I thought I saw maps in the CCP briefing, but no mention here.

Involves matching funds (not required) or in-kind support from partners:

Dr. Thierry Work with the U.S. Geological Survey and Dr. Greta Aeby with the University of Hawaii have been instrumental in work with the corallimorph thus far and will continue to lend their expertise and time to this project.

Budget:

The 2013 marine ecosystem response to shipwreck removal project will cost a total of \$40,000. We anticipate that of this total amount, approximately \$9,000 will be needed for travel expenses including transportation Honolulu to Palmyra at \$3,000 per round trip; \$27,000 for lodging at Palmyra for 30 days, at \$300 per person per day; \$4,000 for field work, supplies, and other project expenses.